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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/883,366

06/19/2001

Toshiya Ishio

1035-330

1077

23117

7590

06/01/2007

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EXAMINER

IM, JUNGHWAN M

ART UNIT

PAPER NUMBER

2811

MAIL DATE

DELIVERY MODE

06/01/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

**Office Action Summary**

Application No.

09/883,366

Applicant(s)

ISHIO ET AL.

Examiner

Junghwa M. Im

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 March 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,5,6,10,17-19,21-25,28 and 35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,5,6,10,17-19,21-25,28 and 35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 14, 2007 has been entered.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 5-6, 10, 17-18, 21-25, 28 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maitani et al. (US 6656828), hereinafter Maitani in view of Farnwarth (US 5851911) and Gamota et al. (US 5682066), hereinafter Gamota.

Regarding claims 1, 6 and 17, Fig. 5 of Maitani shows a semiconductor device comprising:

a main conductor layer/a wiring layer (6; Cu) having an end that is electrically connected to an electrode pad (BP);

an insulating layer (3) having an opening section on said main conductor layer;

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a protrudent electrode (2) electrically connected to the main conductor layer via said opening section, the bump made of a metal having Sn as its main component (col. 7, line 51); and

a metal layer (14, 15) provided completely covering a bottom surface, but not completely covering side surfaces, of the opening section on the main conductor layer so that said metal layer is provided between said main conductor layer and the protrudent electrode, wherein said metal layer includes a nickel layer (14) and the gold layer (15), wherein said nickel layer is made of Ni by electroless plating (col. 7, lines 33-35); and said gold layer is made of Au.

Fig. 5 of Maitani shows most aspects of the instant invention except the upper surface of the copper layer is exposed by the opening section and Ni/Au layer formed in the opening. Fig. 2h of Farnworth shows a copper layer (1064) exposed.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Farnwoth into the device of Maitani in order to have the upper surface of the copper layer exposed by the opening section to reduce the process step.

The combination of Maitani/Farnworth shows most aspects of the instant invention except a Ni layer (barrier layer) formed in the opening. Gamota discloses Ni/Au layer on the copper layer (col. 2, lines 39-51).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Gamota into the device of Maitani/Fawnworth in order to have a Ni layer in the opening to improve the wettability.

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Regarding claim 5, Maitani discloses the metal layer has a thickness ranging from 0.003 um to 1 um (col.9, lines 56-57).

Regarding claim 10, Fig. 5 of Maitani shows a foundation metal layer (13) made of Ti, Ti-w, Cr, or a metal having any of those elements as its main component, under the main conductor layer (col.7, line 23).

Regarding claim 18, Fig. 5 of Maitani shows the main conductor/wiring layer comprises first (6) and the second (13) metal layers.

Regarding claim 21, Maitani discloses the metal layer has a thickness ranging from 0.003 um to 1 um (col.9, lines 56-57).

Regarding claim 22, Fig. 5 of Maitani shows a protruding electrode bump.

Regarding claim 23, Fig. 5 of Maitani shows the conductive wiring layer is connected to the electrode pad (BP) via an opening formed in another insulating layer.

Regarding claim 24, Maitani discloses that the other insulating layer comprises an inorganic layer (10, 11; SiO<sub>2</sub>; col. 7, line 66) and an organic layer (4; polyimide; col. 6, line 13).

Regarding claims 25, 28 and 35, Fig. 5 of Maitani shows a semiconductor device comprising:

a semiconductor device comprising:

a conductive wiring layer (6) connected to an electrode pad (BP), an insulating layer (3; polyimide resin) on the conductive wiring layer having an opening which exposes an upper portion of the conductive layer, a metal layer (15) having lateral dimensions by the size of the opening, completely covering the upper surface of the conductive wiring layer in the opening section but not completely covering the sides of the opening, and a bump electrode (2) being

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mainly made of Sn electrically connected to the conductive wiring layer via said opening section; and

wherein the conductive wiring layer comprises first (6), second (13) and the third (14) metal layers, the third layer (14; Ni) having low reactivity with the insulating layer.

Fig. 5 of Maitani shows most aspects of the instant invention except the upper surface of the copper layer is exposed by the opening section and Ni/Au layer formed in the opening. Fig. 2h of Farnworth shows a copper layer (1064) exposed.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Farnworth into the device of Maitani in order to have the upper surface of the copper layer exposed by the opening section to reduce the process step.

The combination of Maitani/Farnworth shows most aspects of the instant invention except a Ni layer (barrier layer) formed in the opening. Gamota discloses Ni/Au layer on the copper layer (col. 2, lines 39-51).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Gamota into the device of Maitani/Farnworth in order to have a Ni layer in the opening to improve the wettability.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Maitani, Farnworth and Gamota as applied to claim 18 above, and further in view of Greer (US 6451681).

Regarding claim 19, the combined teachings of Maitani /Farnworth/Gamota show substantially the entire claimed structure except "the first layer having a barrier layer and an

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adhesion layer.” Fig.3 of Greer shows the first layer having a barrier layer (122) and an adhesion layer (200).

It would have been obvious to one of ordinary skill in the art to incorporate the teachings of Greer of into the device of Maitani/Farnworth/Gamota in order to have a multi-layered metal layer to improve the connection between the bump and the wiring layer.

### ***Response to Arguments***

Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne A. Gurley can be reached on (571) 272-1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Junghwa M. Im  
Examiner  
Art Unit 2811

jmi